Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion

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2007

Canadian Technical Report of Fisheries and Aquatic Sciences 2774

Fisheries and Oceans Canada | Pêches et Océans Canada

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Canadian Technical Report of Fisheries and Aquatic Sciences

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Cat. No. Fs 97-6/2774E ISSN 0706-6457

Correct citation for this publication:

P. Doherty and T. Horsman. 2007. Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion. Can. Tech. Rep. Fish. Aquat. Sci. 2774: 57 + xii pp.

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Acknowledgements

The authors are indebted to the participants of the Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf and to the various scientists and experts interviewed for sharing the knowledge on which this study is based. The following people are also thanked for providing comments on an earlier draft of this report and for their careful review of this report: Scott Coffen-Smout, Oceans and Coastal Management Division (OCMD), Fisheries and Oceans Canada (DFO), and Nell den Heyer, Dalhousie University. Melanie Hurlburt (OCMD) is also thanked for coordinating the review of this report.

Executive Summary

In order to support the integrated, ecosystem-based management of Canada's oceans, Fisheries and Oceans Canada (DFO) is undertaking programs to identify ecologically and biologically significant areas (EBSAs) in a number of regions, including the Scotian Shelf. Areas can be ecologically significant because of structural properties and/or because of the functions they serve in the ecosystem. Concluding that an area is ecologically significant does not give it any legal status. However, such a conclusion provides guidance on the standard of management that is considered to be appropriate.

Experiential knowledge which includes scientific experts', fishermen's and Aboriginal knowledge is a vital component in the identification of EBSAs. The intent of this study was to gather scientific expert opinion to contribute to the identification of EBSAs on the Scotian Shelf. The assumption is that science expert opinion is based on a life's work rather than any particular project or set of data, and therefore is not readily accessible from the literature.

At the Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf, participants were asked to identify areas of particularly high ecological significance based on the EBSA criteria (uniqueness, aggregation, fitness consequences, naturalness, resilience), delineate the approximate boundaries of each area on a map, and provide justification for selecting each area. In addition, interviews with scientific experts were conducted following the workshop to help fill gaps related to EBSA identification that were identified at the workshop. Forty-five experts participated, representing federal and provincial governments, academia, the Fishermen and Scientists Research Society, and conservation organizations, among others.

On the offshore Scotian Shelf and environs, 42 areas of high ecological significance and four areas requiring further investigation were identified. Of these proposed EBSAs, five areas were identified by a minimum of five experts. These areas were Northeast Channel, the Gully, Haldimand Canyon, Shortland Canyon, and the Stone Fence and Laurentian environs. The identification of proposed EBSAs was based most often on the aggregation criterion (32/42) either alone or in combination with other criteria, although identification based on uniqueness was a close second (29/42). Almost one quarter of the proposed offshore EBSAs (24%) were identified, at least in part, for their benthic communities (e.g., corals, sponges, cold seep communities).

In the inshore Scotian Shelf, 47 areas of high ecological significance were identified. Of these proposed EBSAs, four areas were identified by a minimum of five experts. These areas were Lobster Bay, Cape Sable Island area, Bird Islands area and St. Paul's Island area. The identification of proposed inshore EBSAs was based most often on aggregation (44/47) either alone or in combination with other criteria, although identification based on fitness consequences in combination with other criteria was also common (37/47). Uniqueness was the primary criterion chosen the least (26/47) to describe proposed inshore EBSAs.

Inshore areas were identified as proposed EBSAs for various reasons. Approximately 30% of the areas were identified as highly productive, the majority of which were associated with macrophyte beds, primarily eelgrass or kelp. Eleven of the 47 inshore areas were described as having eelgrass beds. About 47% of the inshore areas were identified as proposed EBSAs, in part, due to the presence of birds. About 23% of inshore areas were identified, in part, because of the importance of those areas for spawning or for the potential for species (e.g., lobster) to reproduce in the area.

Almost half (47%) of the inshore areas were identified by three primary criteria, compared to 31% for offshore areas. Two primary criteria were chosen to describe 36% and 38% of inshore and offshore areas, respectively. Fifteen percent of inshore areas were identified by one primary criterion, compared to 31% for the offshore areas. The secondary criteria of naturalness and resilience were selected more often in the inshore than the offshore.

Areas not proposed as EBSAs should not be assumed to be unimportant or not ecologically significant. They may be areas for which 1) information exists but the areas are not considered important based on EBSA criteria, 2) information exists but is insufficient to assess the importance of the area, or 3) little to no information exists. It is important to recognize why areas have not been proposed as EBSAs.

Historical ecological and biological significance are important factors to be considered in the identification of EBSAs. The rationale being that there are habitats that may not currently support species which were once present but which may be significant to population or species recovery. For example, there are many rivers along the Atlantic coast of Nova Scotia that once supported salmon populations. Without considering the historical context and potential importance of these areas to population or species recovery the ecological significance may not be apparent.

The information presented in this report represents one of several components in the process to identify EBSAs on the Scotian Shelf. Other sources of data, including biological and physical data and fishermen's knowledge, will be used to identify, refine and finalize the boundaries of EBSAs on the Scotian Shelf. In addition, given the number and geographic extent of identified areas, it may be necessary to establish criteria for ranking the importance of EBSAs.

Given that EBSAs have no legal status, more discussion on their use in ocean planning and management is required. The Oceans and Coastal Management Division will lead and prepare a use and risk analysis, vulnerability/sensitivity assessment, and develop management recommendations and appropriate monitoring options for EBSAs on the Scotian Shelf.

Résumé

En appui de la gestion écosystémique intégrée des océans du Canada, Pêches et Océans Canada (MPO) entreprend des programmes d'identification des zones d'importance écologique et biologique (ZIEB) dans diverses régions, y compris le plateau néo-écossais. Une zone peut être d'importance écologique à cause de ses propriétés structurales et/ou des fonctions qu'elle remplit dans l'écosystème. La conclusion à l'effet qu'une zone est d'importance écologique ne lui confère pas un statut légal. Elle sert par contre à établir le niveau de gestion considéré comme approprié.

Le savoir expérientiel, qui inclut le savoir des experts scientifiques, des pêcheurs et des Autochtones, constitue un élément vital dans l'identification des ZIEB. L'objet de la présente étude était de recueillir l'opinion des experts scientifiques dans le but d'identifier les ZIEB du plateau néo-écossais, l'hypothèse voulant que leur opinion est le fruit de toute une vie de recherche plutôt que d'une étude particulière ou d'un jeu de données, et donc qu'elle ne se trouve pas facilement dans les ouvrages scientifiques.

Lors de l'atelier sur l'écosystème côtier et les zones d'importance du plateau néo-écossais, on a demandé aux participants d'identifier les zones d'importance écologique particulièrement élevée en regard des critères servant à les distinguer (unicité, concentration, conséquences sur la valeur adaptative, caractère naturel, résilience), d'établir sur une carte les limites approximatives de chaque zone et de justifier le choix de chacune. De plus, on a tenu des entretiens avec des experts scientifiques après l'atelier afin de combler les lacunes dans les données sur les ZIEB identifiées lors de l'atelier. Ont participé à cette initiative 45 experts, représentant les gouvernements fédéral et provinciaux, des universités, la Fishermen and Scientists Research Society et des organisations vouées à la conservation, entre autres.

Dans le secteur hauturier du plateau néo-écossais et aux alentours, 42 zones d'importance écologique élevée et quatre zones devant être étudiées davantage ont été identifiées. De ces ZIEB proposées, cinq ont été identifiées par au moins cinq experts. Ce sont le chenal Northeast, le Gully, le canyon Haldimand, le canyon Shortland et les abords du Stone Fence et du chenal Laurentien. L'identification de ces ZIEB reposait le plus souvent sur le critère de la concentration (32/42), soit seul ou en combinaison avec d'autres critères, quoique l'identification reposant sur l'unicité suit de près (29/42). Presque 25 % des ZIEB hauturières ont été proposées, en partie, en raison de leurs communautés benthiques particulières (p. ex. coraux, éponges, communautés des profondeurs).

Dans le secteur côtier du plateau néo-écossais, 47 zones d'importance écologique élevée ont été identifiées. Des ZIEB proposées, quatre ont été identifiées par au moins cinq experts. Ce sont la baie Lobster, l'île Cap-de-Sable, les îles Bird et l'île St. Paul. L'identification des ZIEB côtières proposées reposait le plus souvent sur le critère de la concentration (44/47), soit seul ou en combinaison avec d'autres critères, bien que l'identification reposant sur les conséquences sur la valeur adaptative en combinaison

avec d'autres critères était également commune (37/47). L'unicité était le critère primaire le moins choisi (26/47) pour décrire les ZIEB côtières proposées.

Les zones côtières identifiées comme des ZIEB éventuelles l'ont été pour diverses raisons. Environ 30 % ont été identifiées comme étant des zones hautement productives, la plupart comprenant des gisements de macrophytes, principalement des zostères ou des laminaires. Parmi les 47 zones côtières, 11 abritent des gisements de zostère. Environ 47 % des zones côtières proposées comme ZIEB l'ont été en partie à cause de la présence d'une grande diversité d'oiseaux et environ 23 % en partie à cause de leur importance comme frayères ou lieu potentiel de reproduction de certaines espèces (p. ex. le homard).

Presque la moitié (47 %) des zones côtières ont été identifiées en regard de trois critères primaires, en comparaison de 31 % dans le cas des zones hauturières. Deux critères primaires ont été choisis pour décrire 36 % et 38 % des zones côtières et des zones hauturières respectivement : 15 % des zones côtières ont été identifiées en regard d'un critère primaire en comparaison de 31 % pour les zones hauturières. Les critères secondaires de caractère naturel et de résilience ont été choisis plus souvent dans le cas des zones côtières que des zones hauturières.

Il ne faut pas supposer que les zones qui n'ont pas été proposées comme ZIEB n'ont pas d'importance écologique. Ce peut être des zones pour lesquelles 1) de l'information est disponible mais qui ne sont pas considérées comme importantes d'après les critères de ZIEB, 2) de l'information est disponible mais insuffisante pour évaluer leur importance ou 3) peu ou pas d'information a été recueillie. Il est important de reconnaître pourquoi des zones n'ont pas été proposées comme ZIEB.

L'importance écologique et l'importance biologique passées sont des facteurs importants à considérer dans l'identification des ZIEB, la logique étant qu'il existe des parcelles d'habitat qui n'abritent peut-être plus à l'heure actuelle des espèces qui y étaient présentes autrefois, mais qui pourraient être importantes pour le rétablissement d'espèces ou de populations. Par exemple, de nombreuses rivières de la côte atlantique de la Nouvelle-Écosse abritaient autrefois des populations de saumons. Si l'on ne tient pas compte du contexte historique ou de l'importance potentielle de ces zones pour le rétablissement d'espèces ou de populations, leur importance écologique peut ne pas être évidente.

L'information ci-présentée constitue l'un des éléments du processus d'identification des ZIEB du plateau néo-écossais. D'autres sources de données, y compris des données biologiques, des données physiques et le savoir des pêcheurs, seront utilisées pour identifier, affiner et finaliser les limites des ZIEB du plateau néo-écossais. De plus, étant donné le nombre et la superficie des zones identifiées, il pourrait se révéler nécessaire d'établir des critères de classement de l'importance des ZIEB.

Étant donné que la désignation de ZIEB ne confère aucun statut légal, d'autres discussions sur leur utilisation dans la planification et la gestion des océans sont requises. La Division de la gestion côtière et des océans dirigera et mènera une analyse de l'utilisation et du

risque ainsi qu'une évaluation de la vulnérabilité et de la sensibilité, et formulera des recommandations de gestion et des mesures de surveillance appropriées pour les ZIEB du plateau néo-écossais.

Introduction

In order to support the integrated, ecosystem-based management of Canada's oceans, Fisheries and Oceans Canada (DFO) is undertaking programs to identify ecologically and biologically significant areas (EBSAs) in a number of regions, including the Scotian Shelf. Areas can be ecologically significant because of structural properties and/or because of the functions they serve in the ecosystem. As outlined in DFO (2004), identifying EBSAs is not a general strategy for protecting all habitats and marine communities that have some ecological significance. "Rather it is a tool for drawing attention to an area that has particularly high ecological or biological significance, to facilitate provision of a greater-than-usual degree of risk aversion in management of activities in such areas" (DFO 2004).

As outlined by DFO (2004), experiential knowledge must be included in the process of identifying EBSAs. Thus, the intent of this study was to gather scientific expert opinion to contribute to the identification of EBSAs on the Scotian Shelf. The assumption is that science expert opinion is based on a life's work rather than any particular project or set of data, and therefore is not readily accessible from the literature.

Methodology

Overview

At the Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf (DFO 2006), participants were divided into working groups of 5-10 individuals of mixed expertise, focusing on either inshore or offshore areas of the Scotian Shelf. On the first day of EBSA identification exercises, participants were asked to identify areas of particularly high ecological significance based on the EBSA criteria (uniqueness, aggregation, fitness consequences, naturalness, resilience), delineate the approximate boundaries of each area on a map, and provide justification for selecting each area (see Appendices 1 and 2 for methodologies). Areas identified as proposed EBSAs should meet the EBSA criteria to a higher degree than other similar areas or areas with similar characteristics.

On the second day, all the working groups' selections were superimposed onto two maps (inshore and offshore) with areas shaded in accordance with the degree of overlap. All inshore and offshore groups, respectively, were combined to allow for discussion of the proposed EBSAs identified on the previous day, to refine the boundaries of the identified areas to a finer scale, and provide further justification for selecting an area as a proposed EBSA.

Following the workshop, interviews were conducted with various experts identified by workshop participants as having expertise that was not represented at the workshop. These individuals followed the same process to identify EBSAs as the workshop participants. In total, 45 experts representing federal and provincial governments, academia, the Fishermen and Scientists Research Society, and conservation organizations, among others, participated in EBSA identification. Participants' fields of expertise included biological, physical and chemical oceanography, marine fish, benthic ecology, marine plants, geology, marine mammals, marine invertebrates, and marine birds. A list of workshop participants and experts interviewed can be found in Appendix 3.

Study Area

The study area for the inshore was defined as the inshore area of the Scotian Shelf from Cape North to Cape Sable Island. The inshore is defined as the current inshore limit of the DFO Research Vessel Trawl Survey, less than 50 fathoms depth or less than 12 nautical miles (NM) offshore. For the offshore, the area was defined as the Scotian Shelf seaward of the 12 NM limit. However, during the EBSA identification exercises these boundaries were used as guides only and ecologically relevant boundaries were taken into consideration. Thus some of the proposed EBSAs extend outside the study areas.

Participants in the offshore working groups were presented with a map of the Scotian Shelf, where the Canadian Hydrographic Service (CHS) Chart 801a was overlaid on the CHS 15 arc second bathymetry (the highest resolution bathymetry data available shelf-wide) (Figure 1).

Figure 1. Example of offshore map presented to scientific experts during the mapping exercise. The workshop maps were at ~1: 870 000 scale and 35 inches by 55 inches in size.

Participants in the inshore working groups were presented with two maps at approximately 1:300 000 scale which together span the western and eastern inshore regions of the Scotian Shelf from Yarmouth (west) to St. Paul's Island (east) at the tip of Cape Breton Island and included all areas within the territorial sea (12 NM from the baselines of the coast) (Figure 2).

Figure 2. Example of inshore maps presented to scientific experts during the mapping exercise. The workshop maps were at ~1: 300 000 scale and 35 inches by 59 inches in size.

Data Collection

Participants in each group drew boundaries for areas they identified as "ecologically and biologically significant" on these maps. The areas were enumerated and participants were required to record the information requested on the standardized site selection form (Appendix 2).

In addition to the base maps described above a clear acetate overlay map was attached to each that had either 4 minute (offshore) or 2 minute (inshore) grid cells with unique identification numbers (ID), also referred to as "planning units" (Figure 3). Based on the boundaries drawn on the map during the workshop, the participants were asked to record all the planning units that overlap any portion of the identified area on the same form [Note: In a small portion of instances, less than 10%, this was not done or included transcription errors. In all cases the planning units for these areas were confirmed, and when necessary, corrected by the authors of this report.]

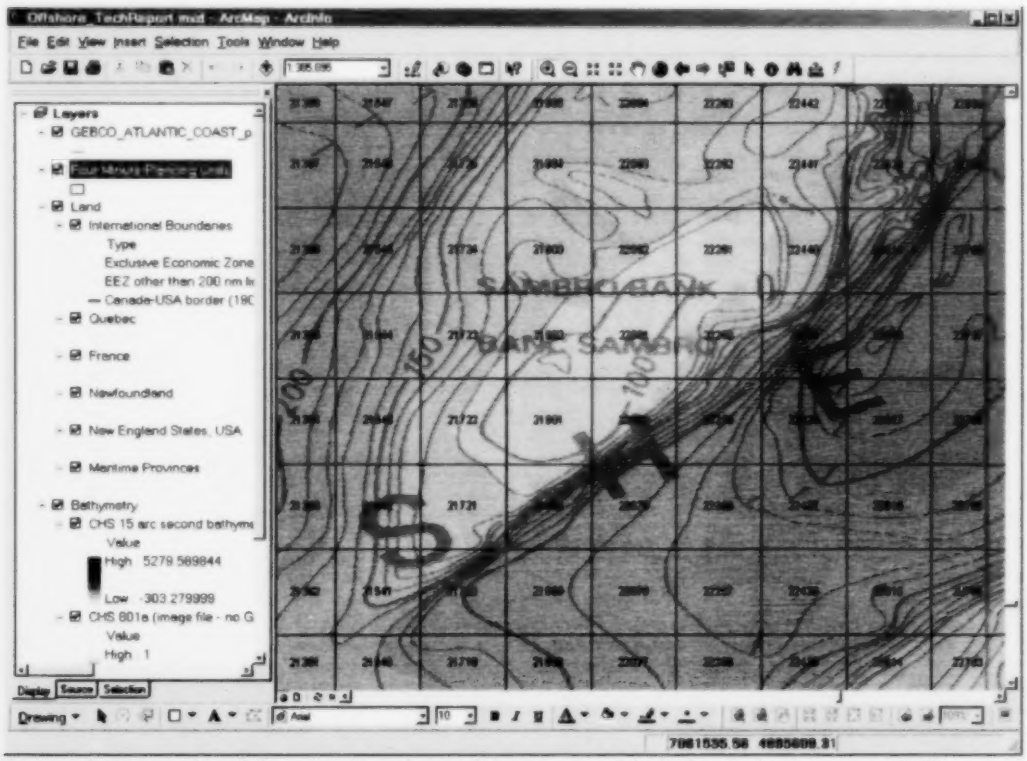

Figure 3. Example of the user interface of the geographic information system (GIS) showing the map data presented to workshop participants with the uniquely identified 4 minute grid cells overlaid on the map. The grid cells which corresponded to the proposed EBSA delineations were identified by the scientific experts.

The boundaries of proposed EBSAs identified by scientific experts were digitized, and all comments and records relevant to each area were stored in a GIS. Boundaries of proposed EBSAs based on scientific expert knowledge were determined by examining actual

boundaries drawn by workshop participants or experts interviewed and any associated descriptive text provided.

Results

Offshore Areas

On the offshore Scotian Shelf and environs, 42 areas of various sizes, shapes, habitat types and geographic distributions were identified to be of high ecological significance (Figure 4, Table 1). Additionally, four areas requiring further investigation were identified (Table 2). Based on the planning units selected, of the 42 proposed EBSAs, five areas were identified by five or more experts.[1] These areas were Northeast Channel (#5), the Gully (#24), Haldimand Canyon (#25), Shortland Canyon (#26) and the Stone Fence and Laurentian environs (#36) (Figure 5, Table 1).

The identification of proposed EBSAs was based most often on aggregation (32/42) either alone or in combination with other criteria, although identification based on uniqueness was a close second (29/42) (Table 3). Some areas (12 of the 42) were identified based solely on one of the three primary criteria: 1) uniqueness (Logan Canyon and the sandy area north of Banquereau); 2) aggregation (Emerald Bank; the Bull Pen, Cow Pen and the Owl; and the Noodles); and 3) fitness consequences (7/42). The seven areas identified based solely on fitness consequences are banks (Roseway Bank, Baccaro Bank, Sambro Bank, Emerald Bank, Middle Bank, Canso Bank, and Banquereau). They were identified as proposed EBSAs based on the assumption that each bank may support a sub-population of cod or other groundfish species. Thus each of these banks may be of high ecological significance because of fitness consequences for these sub-populations. In general, 'fitness consequences' was the least frequently chosen primary criterion for proposed offshore EBSAs.

Thirty-eight percent (16/42) of the offshore areas were identified by two primary criteria (Uniqueness and Aggregation: 13/42; Aggregation and Fitness: 3/42) either alone or in combination with at least one of the secondary criteria, and 31% (13/42) of the offshore areas met all three of the primary criteria (Table 4). Two areas met all five criteria: Southwest Nova Scotia and the frontal area from Browns Bank, and Roseway Basin.

Offshore areas were identified as proposed EBSAs for various reasons. Almost one quarter of the areas (24%) were identified, at least in part, for their benthic communities (e.g., corals, sponges, cold seep communities): The Rock Garden, Northeast Channel, LaHave Basin, Emerald Basin, Emerald Basin and the Patch, the Gully, Eastern Shoal, Stone Fence and Laurentian environs, Laurentian Channel cold seep, Banquereau (sandy area north of Haldimand Canyon). Five areas were selected based on the ecological significance of that area for a single species: two areas on the northern edge of Georges

[1] One expert is defined as either one individual interviewed or one working group (approximately 5-10 people) from the Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf. Within a working group, an EBSA may have been identified by one or several participants. When an individual was consulted it was to gather information that the working group considered to be lacking. In all cases, the working group recommended the individual scientific expert whose area of expertise was not represented at the workshop.

Bank (herring spawning and tube worm habitat, respectively), Emerald Bank (copepods), deep holes north of Banquereau (snow crab) and deep holes of Canso area (lobster).

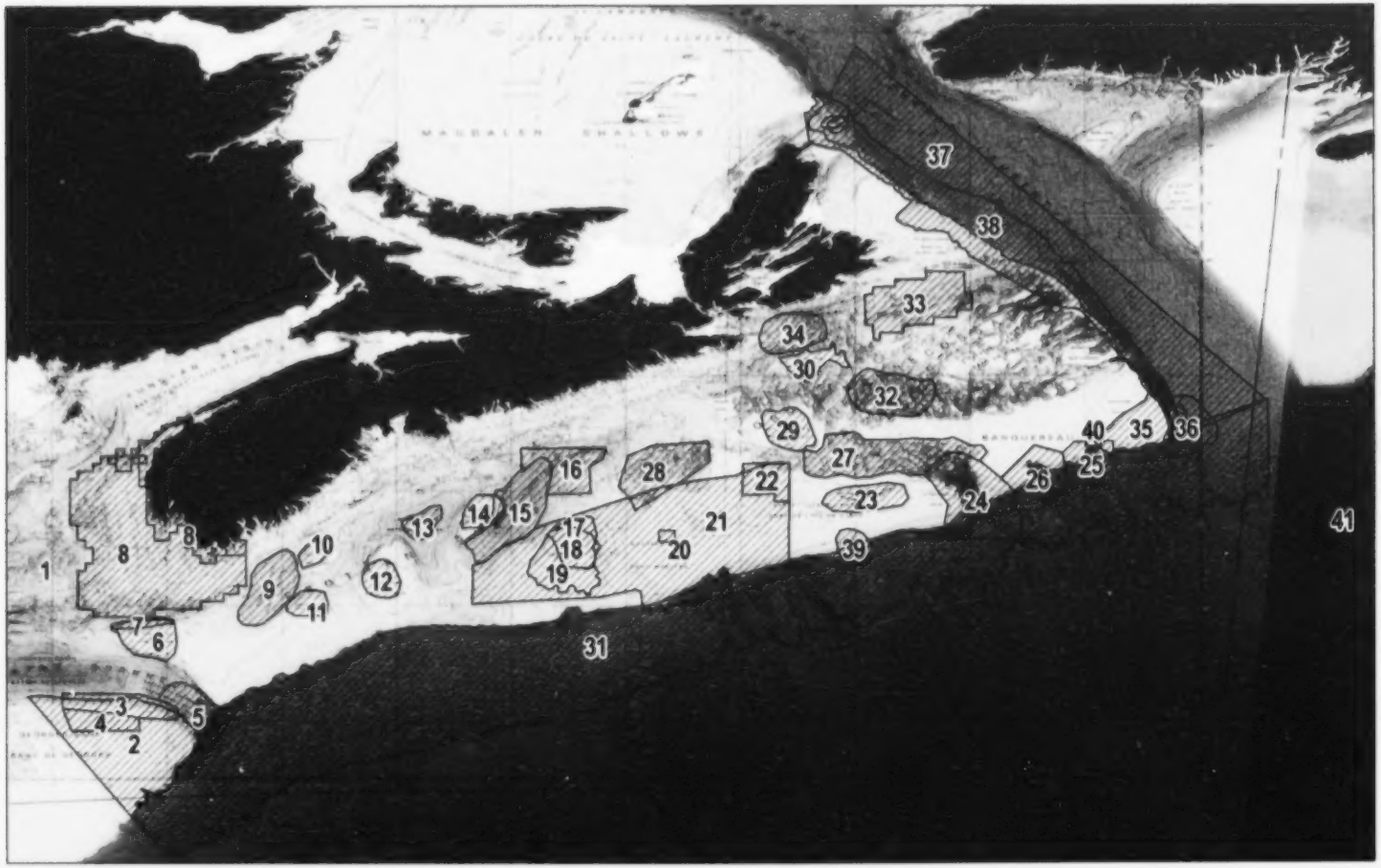

Figure 4. Map of offshore areas identified by scientific experts as proposed areas of ecological and biological significance.

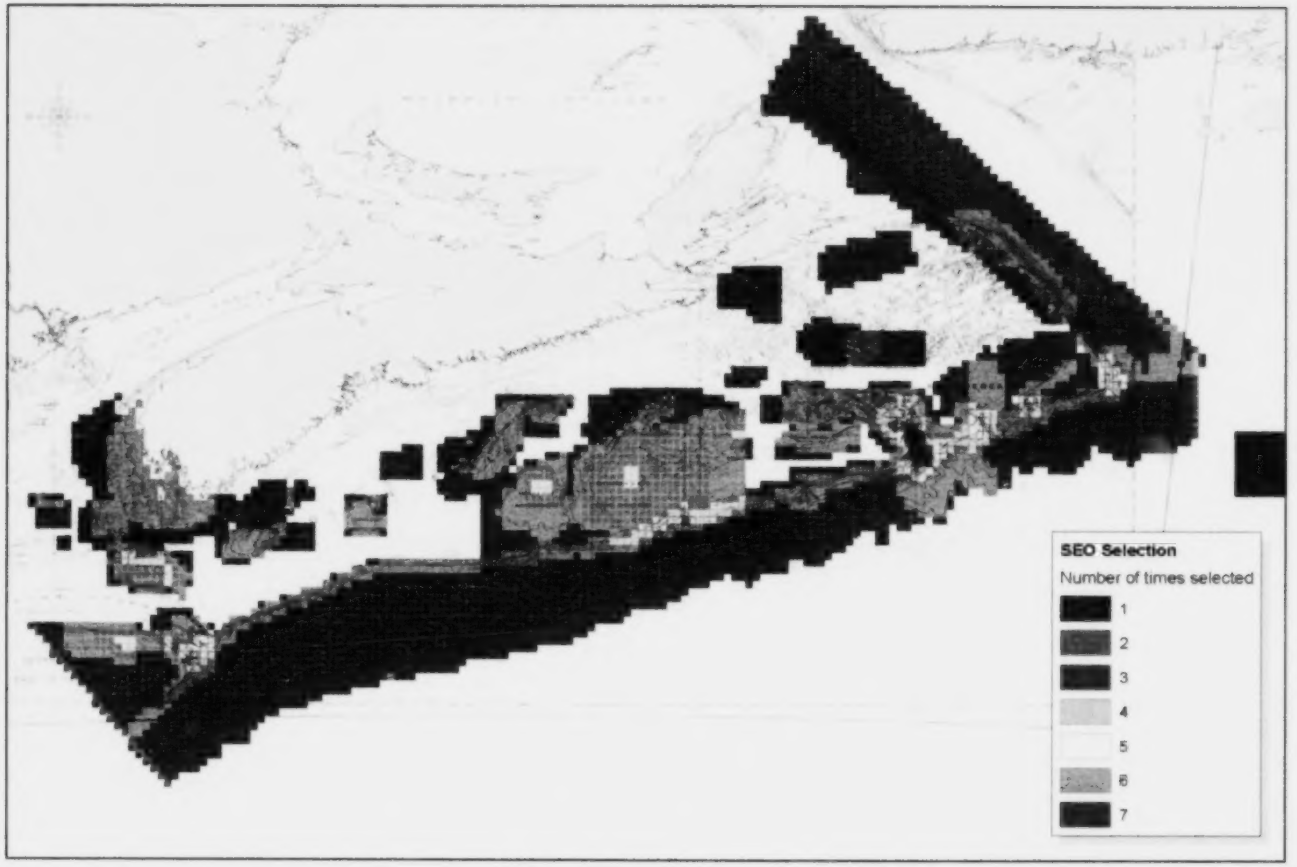

Figure 5. Map indicating number of times an offshore area was selected by scientific experts.

Table 1. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
1	The Rock Garden	High concentration of & diverse community of epifauna. Complex bottom; recent surveys show unique habitat, unique bedrock outcrop, and unique and diverse benthic community (e.g., corals, anemones, benthic invertebrates) in some areas. Dense aggregations of krill.	✓	✓		✓	
2	Canadian portion of Georges Bank	Very strong tidal currents over steep topography lead to a tidal mixing front along the northern flank of Georges Bank. As a result of the frontal dynamics, nutrients are upwelled into the frontal zone. This nutrient pump feeds a very productive ecosystem which continues to support active fisheries. The primary production has been estimated to be about 40% greater than the surrounding shelf regions and the fish production is twice that of the surrounding areas. The Georges Bank tidal mixing front is likely the largest in Canada and one of the largest in the world. Arguments for the ecological and biological significance of Georges Bank have been made many times. The 1999 Georges Bank Moratorium Review (Oil and Gas Exploration) Panel Report provides an accessible version of the argument (www.cnsopb.ns.ca/archives/review.html). The bank is highly productive with diverse communities; it is a spawning, breeding and feeding area for a myriad of species and a migration route for many more. The area provides spawning and nursery grounds for cod and haddock, spawning and settling area for scallops, spawning and summer residence for deep water lobster.	✓	✓	✓		
3	Northern Edge of Georges Bank- herring spawning area	This is a well documented herring spawning area. Spawning is dependent on the seabed and herring go back to this well defined area every year to spawn.	✓	✓			
4	Northern Edge of Georges Bank - tubeworm habitat	This may be unique tube worm (*Filograna implexa*) habitat, at least regionally. Tube worm colonies cover the gravel in this area and have not been seen on the rest of the Scotian Shelf to the north. The area also has interesting geological features.	✓	✓			
5	Northeast Channel - corals, whales	This is a highly productive area where corals are found in densest aggregations in Atlantic Canada. Three species of deep water Gorgonian corals are found: *Paragorgia arborea* and *Primnoa resedaeformis* [the 2 dominant species] and Acanthogorgia species. Juvenile redfish are associated with the corals. The area should include all areas of high coral densities at the mouth of the NEC. This area includes the "Hell Hole" which is an area of aggregation of pelagic species. In entrances of channels, you expect to get a high diversity of whales. There are likely a variety of species from dolphins to deep diving whales (e.g., sperm whales). This is a well-known swordfish aggregating area.	✓	✓			

Table 1 *cont'd*. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
6	Browns Bank and edge slope	Known concentration of large lobsters. In terms of fitness consequences, these lobsters may produce larvae which seed areas off southwestern Nova Scotia. The area supports cod & haddock spawning, gadoid nurseries, lobster protected area, aggregation of scallops, and natural refugia on the north side. There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structures. Fitness could be enhanced by protecting an array of suitable habitat such as Browns Bank.		✓	✓		
7	Fundian Moraine (Browns Bank)	Unique geology. Highly productive area with strong currents and local turbulence. High aggregation of scallops, hand line for fish on the moraine itself. Major haddock and cod spawning area (seasonal closure). Marine mammals, seabirds.	✓	✓			
8*	Southwest Nova Scotia and frontal area from Browns Bank	Very strong tidal currents over rough topography lead to a tidal mixing front along the 100 m isobath (Petrie et al. 1996). The frontal circulation brings nutrients into the well mixed area and this nutrient pump feeds a very productive ecosystem which continues to support active fisheries, such as lobster, the most lucrative fishery in Maritimes region. The large primary productivity makes the area ecologically significant. The area is more productive than most of coastal Nova Scotia in terms of density of animals and macrophytes. This area has uniqueness of tidal range, large tidal flux, and complexity of water movement. Islands in the area have a good boulder face in the intertidal so there is very stable substrate. There is very little ice formation/scour therefore less perturbation of macrophytes in the area. Largest mass of seaweeds on the Scotian Shelf. There is a longer growth period during the year in this area because nutrient supplies are less depleted (higher, more sustained nutrients). There is long term algal population stability and high productivity. Complex shoreline. Lack of grazing pressure. This area has a lower temperature, high chlorophyll *c*, and is a region of high diversity of plankton larvae so it may indicate a benthic recruitment zone. Lobster productivity in the area is high; this must be the world's largest density of lobster. As far as lobsters are concerned, this area is continuous with a deeper population. You don't see this anywhere else. There are settling stage lobster along the frontal zone. The area also supports a haddock nursery for juvenile haddock from Browns Bank (Dave Brickman BIO/OSD), a herring	✓	✓	✓	✓	✓

Table 1 *cont'd*. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
8* *cont'd*	Southwest Nova Scotia and frontal area from Browns Bank	spawning ground (Rob Stephenson, SABS), a herring nursery near Lurcher Shoal, high fish species diversity, abundant whales and porpoises along the front and a Phalaropes staging area. The area includes German Bank which has a moraine, parallel ridges, and rough topography. German Bank supports a scallop broodstock area, herring spawning area, groundfish aggregation, and a deep water lobster spawning area. The area also includes Lobster Bay which has a mud bottom with varied bathymetry (structurally) and supports a high abundance and aggregation of lobster. This is unusual for lobster bottom. Lobster Bay also supports a wolffish population, multiple groundfish species, macrophyte beds (rockweed and kelp) and a diversity of birds (Roseate Terns, Brandt, Oyster Catcher, Piping Plover). Outer Bird Island is an important bird island. South of Cape Sable Island there are productive and sensitive eelgrass beds.					
9	Roseway Basin – Whales	Key feeding area for migrating, highly endangered North Atlantic right whales. Highly productive area, persistent upwelling feature, high level of surface chlorophyll year-round, krill and *Calanus* concentrations. The whales feed on copepods (*Calanus* sp.). This area is very important in regards to fitness because the right whale population is endangered. Other whale species have been observed here and possibly were whaled here (e.g., fin, blue). High concentrations of juvenile redfish.	✓	✓	✓	✓	✓
10	Roseway Bank	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Roseway Bank. Roseway Bank (<100m) was also chosen as an area of interest requiring further research because it may be good habitat for fish due to the rough bottom (mostly boulders, untrawlable). In the areas of the bank that are trawled (approximately 1/3) there are good catch rates of groundfish, including juvenile fish.			✓		
11	Baccaro Bank	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Baccaro Bank.			✓		

Table 1 *cont'd*. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
12	LaHave Bank	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as LaHave Bank. The area is covered in boulders/gravel with a lot of attached biological growth. There is minimal amount of trawling; could this area be self-protected? This area could be an important spawning area.	✓	✓	✓		
13	LaHave Basin	Fields of pockmarks that likely have chemosynthetic cold seep communities. Unique oasis of life on bottom of pockmarks that is fed by venting hydrocarbon gas. Krill and overwintering *Calanus*.	✓	✓			
14	Sambro Bank	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Sambro Bank.			✓		
15	Emerald Basin	Primary residence & spawning ground of silver hake. Overwintering ground of basking sharks (primary) & porbeagle sharks. Residence for whales and dolphins. Summer residence of tuna & swordfish. Important overwintering area for *Calanus* - springtime source to the Western Scotian Shelf. Important aggregation for krill - highest biomass on the shelf. High species richness. Fields of pockmarks that likely have chemosynthetic cold seep communities. Unique oasis of life on bottom of pockmarks that is fed by venting hydrocarbon gas.	✓	✓	✓		
16	Emerald Basin and The Patch	Area in middle of Emerald Basin is glacial material that has not been covered (sometimes boulders) (i.e., it is glacial till that is exposed). This area is a hotspot for large glass sponges, *Vazella pourtalesi* (Class Hexactinellida, Family Porsillidae), also known as Russian Hats, and is the only known monospecific population of *Vazella pourtalesi* on the Scotian Shelf and perhaps anywhere. These sponges are a sessile species, permanently aggregated. Their entire life cycle is spent in this one area (fitness consequences). They are long lived & slow growing. Globally unique; 100% of known population. Not resilient to fishing disturbance (e.g., trawling). The area has been heavily fished but some areas still intact (in terms of naturalness). These sponges provide habitat for other species.	✓	✓		✓	✓
17	Emerald Bank for potential sub-populations of groundfish	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Emerald Bank.			✓		

Table 1 *cont'd*. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
18	Emerald Bank - Hot Box	Supports higher concentrations of fish, although less so than Western or Sable Banks.	✓	✓			
19	Emerald Bank	Seasonally high diversity of copepods. Diversity comes from proximity to the slope so shows a diversity of warmer water zooplankton species in some years.		✓			
20	Western Bank - High fish concentrations	The combination of gravel and sandy seabeds supports higher concentrations of fish, particularly juvenile fish.	✓	✓			
21	Emerald Bank, Western Bank and Sable Bank	Area of highest larval fish diversity perhaps due to a gyre. Area of concentration of spawning fish (e.g., gadoids). Juvenile nursery area for haddock, cod, monkfish, yellowtail, skate, flounder. Source for downstream Browns Bank. Includes the defined 4W Haddock Box Nursery Area which has been closed to groundfish otter trawl since 1987 and to all groundfish fishing since 1993. Important overwintering area in the slope waters.	✓	✓	✓		✓
22	Sable Island Hot Box	Supports higher concentrations of fish. Fish congregate in this area. Confirmed diversity of species (e.g., haddock, sea cucumbers, possible mussel beds). Unexpected hard gravel/bouldery seabed.	✓	✓			
23	Sable Island Area	Area of high fitness consequences for seals (primarily grey seals). Snow crab juveniles? Area with high concentrations of juvenile fish, particularly haddock (young-of-year and age 1).	✓	✓	✓		
24	The Gully	The Gully is a unique geological feature with unique current patterns. Highly productive area. Very high diversity and density of cetacean species. Largest abundance of endangered northern bottlenose whales on the Scotian Shelf. Resident population of northern bottlenose whales uses the Gully, as well as Shortland and Haldimand Canyons. Habitat for aggregations of other whales, including endangered blue & sperm whales, and aggregations of prey of whale species. Area of high finfish diversity. Finfish diversity is related to habitat heterogeneity and depth provides that. The assemblage would include fish with a variety of depth preferences. Large diversity of physical habitats in such a small area. Higher diversity of deep water corals (> 12 species) than other areas. Potentially important habitat for juvenile fishes.	✓	✓	✓	✓	
25	Haldimand Canyon	Aggregation of endangered northern bottlenose whales and probably other species (e.g., sperm and blue whales). Presence of gorgonian corals. Bottlenose whales move between the Gully, Shortland Canyon and Haldimand Canyon, likely along deeper contours (800-1200m).	✓	✓	✓	✓	

Table 1 *cont'd*. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
26	Shortland Canyon	Aggregation of endangered northern bottlenose whales and probably other species (e.g., sperm and blue whales). Presence of gorgonian corals. Bottlenose whales move between the Gully, Shortland Canyon and Haldimand Canyon, likely along deeper contours (800-1200m). Area of high finfish diversity. Finfish diversity is related to habitat heterogeneity and depth provides that. The assemblage would include fish with a variety of depth preferences.	✓	✓	✓	✓	
27	Gully Trough	Common foraging area for seals and marine mammals.		✓	✓		
28	The Bull Pen, the Cow Pen and the Owl	Highly productive area with a large number of both southern and northern fish species. Highly diverse area with a mix of cold and warm water. Possible white hake spawning area.		✓			
29	Middle Bank	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Middle Bank.			✓		
30	Canso Bank	There is strong evidence that sub-populations of cod existed on the Scotian Shelf (tagging, McKenzie 1956). Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Canso Bank.			✓		
31	Scotian Slope/Shelf Break	Includes areas of unique geology (iceberg furroughs, pits, complex/irregular bottom). Slopes are areas of high finfish diversity due to habitat heterogeneity provided by depth. This area has high fish diversity, including demersal, mesopelagic and large pelagic fishes. Primary residence for mesopelagic fishes. Inhabited by corals, whales, porbeagle shark, tuna, swordfish. Primary migratory route for large pelagic fishes (e.g., sharks, swordfish, tuna). Whale migration route. Migratory route for endangered leatherback turtles - the area supports concentrations of salps on which leatherback turtles feed. High diversity of squid. Overwintering area for a number of shelf fish species. Halibut overwintering, lobster overwintering (especially the western end). Seabird feeding/overwintering area. Greenland sharks.	✓	✓	✓		✓
32	Deep holes north of Banquereau	Very productive snow crab bottom. Area of high density of commercial sized snow crab.		✓	✓		
33	The Noodles	Shrimp aggregation. Possible snow crab retention.		✓			
34*	Deep holes of Canso area	Topographically diverse area that serves as a deep water reserve for lobster. Largest lobsters along the Eastern Shore are found here and may serve as larval supply downstream.	✓	✓			✓

Table 1 *cont'd*. Proposed offshore EBSAs identified by scientific expert opinion (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness)

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
35	Eastern Shoal	Aggregation of surf clams, sand lance, scallops and quahogs. Further justification because of gyres in the area and planktonic significance. Unique geology.	✓	✓			
36	Stone Fence and Laurentian environs	Only confirmed location of *Lophelia* coral on the Scotian Shelf. A variety of other corals are also present. Potentially important habitat for juvenile fishes. High energy area. In entrances of channels, you expect to get a high diversity of whales. There are likely a variety of species from dolphins to deep diving whales (e.g., sperm whales).	✓	✓		✓	✓
37*	Laurentian Channel & slope	Overwintering area for 4Vs cod, *Calanus*, white hake, Dover sole, turbot (Greenland halibut), redfish and Greenland shark. Important migration route via Cabot Strait to Gulf.	✓	✓	✓		
38*	Laurentian Channel slope	High fish diversity for demersal, pelagic & mesopelagic fishes. Unique migration corridor for white hake, cod, redfish, flatfish and Greenland shark. Portion of important mating area for porbeagle sharks (COSEWIC). Primary overwintering area for 4T cod (COSEWIC) & white hake. Important aggregation area for krill. Important overwintering area for *Calanus* which supplies the entire Scotian Shelf. Important migration route from Scotian Shelf to Gulf of St. Lawrence & back.	✓	✓	✓		✓
39	Logan Canyon	Area of high finfish diversity. Finfish diversity is related to habitat heterogeneity and depth provides that. The assemblage would include fish with a variety of depth preferences.	✓				
40	Banquereau - Sandy area north of Haldimand Canyon	Very important area for infaunal species (shellfish, surf clams). Lots of shellfish living in sediments, lots of sea urchins.	✓				
41	Laurentian Channel cold seep	Large dense chemosynthetic communities of vesicomyid & thyasind clams, gastropods & galatheid crabs. New family of polychaetes identified. This community is unique to Atlantic Canada and found on crests of gravel waves. Species have specialized tissue with carbon fixing, sulfide oxidizing bacteria.	✓				✓
42	Banquereau - fish sub-populations	There is strong evidence that sub-populations of cod existed on the Scotian Shelf. Using cod as a model, other species may have similar population structure. Fitness could be enhanced by protecting an array of suitable habitat such as Banquereau. For example, Sable Island Bank fish are more genetically similar to each other than to those on Banquereau. Banquereau supports a distinct, genetic population of cod.			✓		

*Area boundaries extend into the inshore (i.e., landward of the 12 NM limit)

Table 2. Areas requiring further investigation

1001	Jordan Basin - near "The Rock Garden"	This is an area of interest. Although the Rock Garden was identified as a potential EBSA, there may be other areas of ecological significance in the same geographic region of the Jordan Basin that warrant further investigation.
1002	Complex benthic area north of Banquereau	This is an area of interest. It is a convoluted, highly dissected area which is a mixture of extreme depths. Thus it is geologically distinct. Tectonically active. Aggregations of shrimp and crab. Preferred shrimp area. Snow crab range limit. There are few data for benthic habitat and biological features.
1003	Scotian Gulf*	This is an area of interest. Modelling has suggested that there is little natural disturbance in this deep channel, implying that any communities there might be especially susceptible to human impacts. Little is known about this area.
1004	Banquereau - Louisbourg Line area	This is an area of interest. Frequent sightings of dolphins and porpoises occur in this area. Louisbourg line between stations 6 and 7. AZMP cruises.

* The Scotian Gulf refers to one of two cross-shelf channels of the Western Scotian Shelf, the other being the Northeast Channel. The Scotian Gulf is the channel between LaHave and Emerald Banks that connect innershelf basins, like Emerald Basin, to the deep ocean (Shore et al. 2000).

Table 3. Criteria chosen by scientific expert opinion to identify proposed EBSAs

Criterion	Inshore	Offshore
Primary Criteria		
Uniqueness	26	29
Aggregation	44	32
Fitness Consequences	37	23
Secondary Criteria		
Resilience	18	8
Naturalness	20	9
TOTAL	47	42

Table 4. Number of primary criteria chosen by scientific expert opinion to identify proposed EBSAs

Number of Primary Criteria	Inshore	%	Offshore	%
1	6	15	13	31
2	18	36	16	38
3	23	47	13	31

*No primary criteria were chosen for the Terence Bay-Pennant Bay area.

Inshore Areas

In the inshore, 47 areas of high ecological significance were identified[2] (Table 5, Figure 6). Of these proposed EBSAs, four areas were identified by a minimum of five experts (Figure 7). These areas were Lobster Bay (#3 in Figure 7 and Table 5), Cape Sable Island area (#4), Bird Islands area (#41) and St. Paul's Island area (#47).

[2] Brier Island/West Port, Annapolis Basin, Whycocomagh Bay and Denys Basin were also identified as proposed EBSAs but are not discussed here because they are not located within the study area.

Figure 6. Map of inshore areas identified by scientific experts as proposed areas of ecological and biological significance.

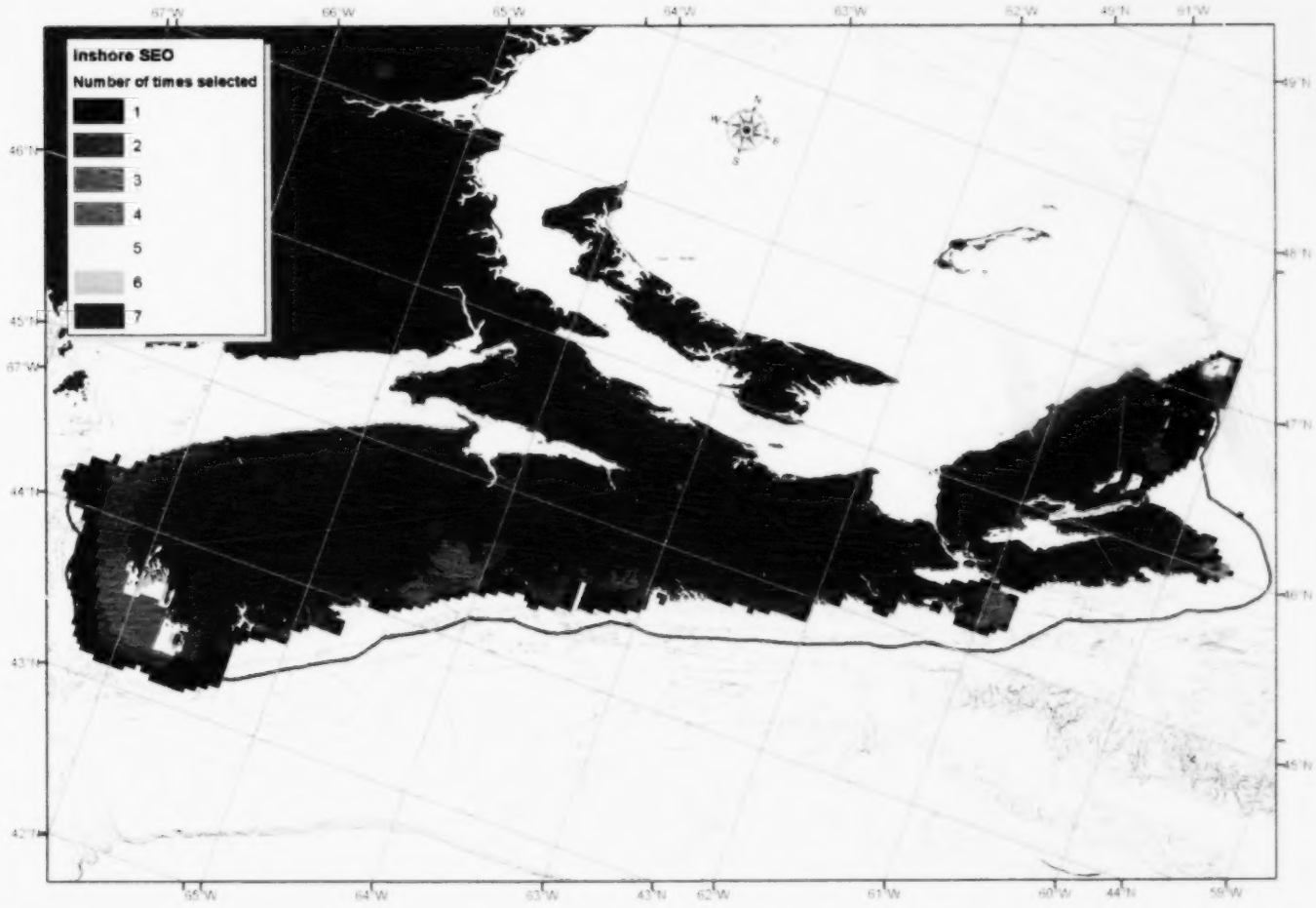

Figure 7. Map indicating number of times an inshore area was selected by scientific experts.

Table 5. Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
1[†]	Southwest Nova Scotia Shelf	Suspect that benthic diversity is greater here. This area is more productive than most of coastal Nova Scotia in terms of density of animals and macrophytes. One of the reasons why it is so productive is because of the large tidal exchange. As far as lobsters are concerned, this area is continuous with a deeper population. You don't see this anywhere else. Lobster productivity in the area is high; this must be the world's largest density of lobster. There are settling stage lobster along the frontal zone. The area also supports a haddock nursery for juvenile haddock from Browns Bank, a herring spawning ground, high fish species diversity, abundant whales and porpoises along the front and a Phalaropes staging area.	√	√	√	√	√
2	Nearshore Southwest Nova	Uniqueness of tidal range, large tidal flux, complexity of water movement. Islands have a good boulder face in the intertidal so there is very stable substrate. Very little ice formation/scour, therefore less perturbation of macrophytes in the area. Lobster productivity in the area is high. Largest mass of seaweeds on the Scotian Shelf. Longer growth period during the year because nutrient supplies are less depleted (higher, more sustained nutrients). Long term algal population stability and high productivity. Complex shoreline. Lack of grazing pressure. Stable substrate. Area of convergence/upwelling and lower temperature, high chlorophyll *c*. Region of high diversity of plankton larvae so it may indicate a benthic recruitment zone. The Trinity and Lurcher area was identified by the Marine Conservation Biology Institute in 1999 as a pelagic priority area based on its exceptional biological resources.	√	√	H		
3	Lobster Bay	Tremendous kelp productivity which must contribute much to secondary productivity. Kelp grow twice as quickly compared to other areas along Atlantic coast. Area is permanently vegetated with kelp; sea urchins are absent from this area. The area is missing *Agarum clathratum*, a kelp species, possibly due to competition from other kelp species. Intermediate richness of nutrients between Atlantic Nova Scotia and Bay of Fundy area. Community dynamics are different. Significant input of freshwater in the area which may account for lack of urchins in the area (urchins have no osmoregulation capacity for freshwater). Unique topography. Biological aggregation, upwelling area, diversity of birds and fish, abundance of lobster, wolffish population, multiple groundfish species, macrophyte beds (rockweed and kelp). Mud bottom with varied bathymetry structurally supports high abundance and aggregation of lobster. This is unusual for lobster bottom.	H	H	H	H	H

Table 5 *cont'd*. Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
4	Cape Sable Island area	Area of high productivity, important migration route. Hawk/Cape Sable Island area has an important dune system that is quite unique, with intertidal flats. Key area for a lot of rare birds. Turning point/migration corridor for a large number of waterfowl. Wintering/spring area for migrating waterfowl, including Common Scoter, Black Scoter, Common Eider, Black Duck, Canada Geese, Scaup. Large movement of Double-crested Cormorants. Spring staging area for Atlantic Brandt, Storm Petrels, Sand Pipers, and Piping Plovers also use the area. Cape Sable Island is an Important Bird Area and Outer Bird Island is an important bird island. Fish species include cod (unsure of other species of fish). Lobster, macrophyte, scallops. South Cape Sable Island has eelgrass beds that are productive and sensitive, and the area provides access to deeper water.	L	M	L	H	M
5	Grey Island	Common Eider colony location. Breeding season April to mid June.		√	√		
6	Green Point to Ram Island	Common Eider molting area (approximately 40 000 individuals) from July to late August/early September. Area includes Jordan Bay Gull Rock which has a mixed colony of Double-crested and Great Cormorants (April to early September).		√	√		
7	Green Harbour and Jordan Bay	High concentration of lobsters that are potentially reproducing.		√	√		
8	Lockeport Harbour	High concentration of lobsters that are potentially reproducing.		√	√		
9	Sable River Migratory Bird Sanctuary	Important wintering area for Canada Geese and Black Duck (November to end of March).		√	√		
10	Sable River	High concentration of lobsters that are potentially reproducing.		√	√		
11	Port Hebert Migratory Bird Sanctuary	Important wintering area for Canada Geese and Black Duck (November to end of March).		√	√		
12	Port l'Hebert	High concentration of lobsters that are potentially reproducing. Productive eelgrass beds. Intertidal through to sub-tidal with good open water access.	L	H	M	H	M
13	Port Jolie and Kejimkujik Adjunct Area	Large array of salt marshes, productive eelgrass areas, bird habitats, etc. Intertidal through to subtidal with good open water access. Includes parts of Thomas Raddall Provincial Park and Kejimkujik Adjunct with undeveloped shorelines. Productive offshore area. Common Eider molting site in fall. Important wintering area for Canada Geese and Black Duck (November to end of March). Piping Plover [endangered] and Harlequin Duck [endangered] use the area. Includes Little Hope Island which has a Great Cormorant colony. The area includes the Port Jolie Migratory Bird Sanctuary.	L	H	M	H	M

Table 5 *cont'd*. Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
14	Port Mouton - Western Channel	Double-crested Cormorant colony		√	√		
15	Herring Spawning Area of Port Mouton	Herring spawning area in the fall. Whales, marine birds, fish and invertebrates feed on herring and eggs.		√	√		
16[2]	LaHave River and islands area	This is a productive shallow shelf habitat with an eelgrass bed in Green Bay. The Petite Rivière estuary is a significant area for the future recovery of the endangered Atlantic whitefish which is now only found within the Petite Rivière watershed. Thus the area supports all biological functions of the complete population giving it high uniqueness, aggregation and fitness consequences. The area is important for anadromous species (e.g., salmon). LaHave River is a wintering area for waterfowl (Bufflehead, Goldeneye and Black Ducks) from October to March. They are found in leads between ice floes. There is also a rare species of plant found year-round along the edge of the upper end of the salt marsh. The LaHave dune system is a shorebird foraging area (principally July to middle of August). The area includes Indian Island, south of the LaHave Islands, which have Double-crested Cormorant and Common Eider colonies. Indian Island is owned by the Nova Scotia Bird Society.	H	H	H	M	
17[2]	Mahone Bay and islands	Mahone Bay is a highly productive area with macrophyte beds. Seabird nesting colonies and coastal waterfowl use is quite significant. Nesting and rearing of many bird species occurs. Unique high density of island habitats representing a diversity of island types. Shoals associated with many islands and sand beaches that could be considered sensitive habitats. Shoals have apparent but undocumented importance in productivity and presence of small fish which makes them a feeding, rearing, reproduction area for birds, but also may have significance for those fish species as well. The islands at the mouth of the Bay have quite extensive kelp beds (e.g., East Ironbound, Little Duck Island and Flat Island) that are still very healthy and dense (not invaded yet by *Codium* and *Membranipora*). Rafuse Island and the northwestern tip of Big Tancook have shallow, extensive eelgrass beds. Grassy Island is one of the few sites known for breeding of the endangered Roseate Tern. Aggregations of puffins and seals around Lunenburg Rocks. The area includes the Pearl Island Wildlife Management Area breeding colony for Razorbill Auks, Puffins and Black Guillemots.	M	MH	M	M	ML

Table 5 *cont'd*. Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
18[2]	St. Margaret's Bay area	The area is highly productive and has a high flushing rate. Bluefin tuna come into the Bay and there is a very big mackerel fishing area. Physical features are representative of the general shelf. The area includes Cranberry Cove which according to ad hoc information from local divers has a diverse sub-littoral community.	√	√			
19[2,3]	Terence Bay-Pennant Bay	The area is a coastal adjunct to a large expanse of crown land. The watershed is relatively unimpacted.					√
20[2]	Sambro Ledges	Many dolphins (especially white-sided and white-beaked dolphins) and minke whales, and sometimes fin whales, aggregate here. Dolphins are present in summer, minke whales year-round. Fin whales sometimes occur in large numbers in winter but not in the last few winters. This area is a feeding ground for whales.		√			
21[2]	Herring Cove and Portuguese Cove area	Wintering and staging area for Common Eider and migrating waterfowl from November to March.		√			
22[2]	Cole Harbour Estuary	There is an interesting salt marsh system and dune system at the head of the inlet. The area is highly productive. Blue crabs keep appearing in this area. Eelgrass is prominent. Migratory birds use the area. Wintering area for the Black Duck and Canada Goose from November to March.	√	√	√		
23[2]	Chezzetcook Inlet to Jeddore Harbour	Diverse mix of salt marsh, eelgrass, sandflats; inshore productive habitat. Bird Areas. Bird migration, overwintering area for Black Ducks. Common Eider breeding habitat. Musquodoboit Harbour is a RAMSAR site and a Wetland of Importance. It is a wintering area for waterfowl (Black Ducks and Canada Geese). Petpeswick Inlet is not a designated site but is linked together with Musquodoboit Harbour. Birds move back and forth between these sites. Generally this is the most northern wintering area for large concentrations of Canada Geese in Canada.	M	H	H	L	L
24[2]	Yankee Bank (30 m depth)	Herring and cod spawning area in the fall. Whale and marine birds feed on herring as do many other marine species such as flounder.		√	√		
25	Duck Island Eider Breeding Colony	Important breeding colony for Common Eider.		√	√		
26	Long Island Eider Breeding Colony	Important breeding colony for Common Eider.		√	√		

Table 5 *cont'd*. Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
27	Taylor Head-Sheet Harbour area	The area encompasses an array of coastal islands and protected nearshore waters that provide habitat (breeding, feeding, rearing) to an array of seabirds. Taylor Head Provincial Park provides opportunities for a relatively unimpacted nearshore marine adjunct. Sheet Harbour/West River has an estuary of a reasonable size. This is a salmon area and is a potential recovery site for this species. There is also a lobster fishery in the area.	M	M	M	H	L
28	Eastern Shore Islands Wildlife Management Area	Area encompasses an array of coastal islands and protected nearshore waters that provide habitat (breeding, feeding, rearing) to an array of seabirds. Important colonies for Common Eider (April to late August). There are many other species as well (Black Guillemot, Double-crested and Great Cormorant, Great Blue Heron, Harlequin Duck, Common Tern).		√	√		√
29	Tobacco Island	Colony for Common Eider and Double-crested Cormorant.		√	√		
30	St. Mary's River and watershed	Important salmon watershed.	H	M	M	H	L
31	Country Harbour and Islands	Country Harbour has several treed and grassy islands that are used by marine birds as nesting habitat. Country Island is one of only two significant Roseate Tern colonies. This species is listed as endangered. Common and Arctic Terns also nest on the Island (April to end of July) as well as a large number of Leach's Storm Petrels (100 000+ individuals).	√	√	√		
32	Sugar Harbour Islands	Breeding colony for Common Eider and some Double-crested Cormorants.		√	√		
33	Canso Ledges Area	This is an area of high productivity: cod, wolffish, lobster, snow crab, cod spawning (historical). There is an extensive Ascophylum nodosum bed in the area. There is a steep depth gradient close to shore, therefore species which are traditionally spread out in quite a narrow span (e.g., lobsters, snow crab, shrimp) are found here. Fin whales used to aggregate here in winter but it is uncertain whether they still do. There is probably a general concentration of dolphins in the summer. It's a feeding area for marine mammals. Spring staging area for migrating waterfowl, particularly Common Eider (late March-April). Also within the area are breeding colonies of Great Blue Heron, Common Eider and Double-crested Cormorant (April to late August) and probably Common and Arctic Terns as well. The area includes Fox Island which in 1987 was a fairly large Eider colony, however the current status is unknown because current data are not available.	√	√	√		

Table 5 *cont'd.* Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
34	Janvrin Islands	Presence of a very extensive rockweed (Ascophylum nodosum) bed that extends approximately 1 km along the south side of the island from low intertidal down to approx. 30 feet deep. Pure bed (100% cover). It is a highly productive, monospecific rockweed bed.	√	√	√	√	√
35	St. Peter's Bay-Bay of Rocks	Area of high productivity and diverse benthic habitat. Mackerel, lobster and herring (and possibly white hake) are all available in the area.		√			
36	St. Peter's Inlet	Area has a mix of exposures and salinity, and scattered deep water eelgrass beds.	M				M
37	Mira Bay Area and Scaterie Island	The area is highly productive. The Northern Head/South Head area is a breeding area for cliff-nesting seabirds including Black-legged Kittiwakes and Great Cormorants. 6.7% of the North American population of Great Cormorants nest in this area. Northern Head/South Head is an Important Bird Area. This is only one of the perhaps 45 locations in Nova Scotia where Kittiwakes nest. The endangered Harlequin Duck is found in the winter time off the heads. Scaterie Island is an Important Bird Area and a grey seal pupping area. It is a wilderness area with breeding colonies of Double-crested and Great Cormorants. South Head and Wreck Point are principle breeding areas for the Great Cormorant. Movement/aggregation of species in this area. Myra Gut has an interesting salinity regime, eelgrass and oysters. Port Morien has a bay behind a barrier beach that is highly productive with large eelgrass beds and migratory birds.	H	H	MH	H	M
38	Big Glace Bay	Eelgrass behind a barrier island.	L	H	H	H	M
39	Indian Bay and Lingan Bay	Principle breeding area for Great Cormorants. Includes three cliff faces and eelgrass behind a barrier island.	L	H	H	H	M
40	Sydney River-Sydney Harbour area	Spawning/breeding/feeding area for multiple species. High diversity of fish species. Very big freshwater streams entering the area (smelt runs, gaspereau runs). This area is unique in Nova Scotia for yellow lampmussels, a species of special concern (upriver).	H			H	

Table 5 *cont'd.* Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
41	Bird Islands	Bird Islands are two islands, vegetated with grassy tops and surrounded by low cliffs. Very important breeding area for colonial seabirds. Very significant colony for Great and Double-crested Cormorants, Puffins, Razorbill Auks and Kittiwakes from April to end of August/beginning September. Species composition is more similar to Newfoundland than Nova Scotia (Auks, Kittiwakes). This is the largest colony of Great Cormorants in North America. It is an Important Bird Area. The area is also important for juvenile fish which likely provide a ready food source for resident seabirds. The site is also important for whale and seal species and is a lobster overwintering area. There is a good, consistent and stable lobster fishery around the area and fishermen fish throughout the season. The area is considered unique for birds and marine mammals. This area is the only shelf area in the whole of Sydney Bight that is shallow and yet quite a large area. It is important for migration, spawning and feeding. There are not a lot of islands off Sydney Bight or eastern Cape Breton so this Island is different from, for example, the Mahone Bay area where there are a lot of islands.	H	H	H	M	M
42	Great Bras d'Or Channel	Inflow of salt water for the Bras d'Or system; gradient of salinity along its length. Transportation corridor for species moving in and out of the Bras d'Or Lakes.	H	M			M
43	Western Sydney Bight	The area is considered unique because 4Vn cod spawn here (late April - end of May). Nursery area for cod and probably other species. Newly settling cod (young-of-the-year) each September.	√	√	√	√	√
44	Ingonish Bay	Whales breeding and feeding in the area.		√			
45	Asby Bay	Marine mammals feeding in the area.		√			
46	Cabot Strait-Asby Bay to St. Paul's Island	This channel between Cape North and St. Paul Island is a migration route used by cod, herring, mackerel, marine mammals and possibly white hake.	H	H	H	√	√

Table 5 *cont'd.* Proposed inshore EBSAs identified by scientific expert opinion. Checks (√) indicate which of the 5 criteria (U=uniqueness, A=aggregation, FC=fitness consequences, R=resilience, N=naturalness) were chosen. H=high, M=medium, L=low.

#	Site name	Rationale for selecting area as a proposed EBSA	Criteria				
			U	A	FC	R	N
47	St. Paul's Island Area	This is a unique system; it is a large island with forested habitat and freshwater lakes. The habitat is relatively unspoiled. There are not a lot of islands off eastern Cape Breton so it's different from, for example, the Mahone Bay area where there are a lot of islands. The area is also considered unique for birds and marine mammals. The colony on the Island is unsurveyed but it is suspected that there is a very large Leach's Storm Petrel colony. The Island is also home to 1% of the Canadian population of Bicknell's Thrush, a landbird which nests there. There are general reports of concentrations of cetaceans in this area. There are a variety of species including sperm whales, baleen whales, pilot whales and dolphins. It is probably a feeding area for cetaceans. Sperm whales may be there year-round but other species are probably not. There is a good, consistent and stable lobster fishery around the Island. Fishermen fish throughout the season. The area may be unique for lobster.	√	√	√		

[1] Area boundary extends past the 12 NM limit

[2] This area is part of a larger area from Coffin Island to Barren Island that is considered unique because of its natural cycling, driven by an oceanographic system which brings in warm water with *Paramoeba invadens*, an amoeba that kills sea urchins. Sea urchins modify the structure and function of this system by eating kelp. Approximately every 10 years *P. invadens* is brought in on warmer waters and kills the sea urchins. The kelp then grows back. It takes several years for the sea urchin population to re-establish. Once this occurs the sea urchins consume the kelp creating sea urchin barrens. This natural decadal cycling system has not been reported elsewhere. Although this area is considered unique because of the natural decadal cycling system, it was not thought to be ecologically significant because of this unique feature.

[3] No primary criteria were chosen for the Terence Bay-Pennant Bay area, although it was identified by one or more of the workshop participants.

The identification of proposed inshore EBSAs was based most often on aggregation (44/47) either alone or in combination with other criteria, although identification based on fitness consequences in combination with other criteria was also common (37/47) (Table 3). Uniqueness was the primary criterion chosen the least (26/47) to describe proposed inshore EBSAs.

Forty-seven percent (22/47) of the inshore areas were identified by three primary criteria either alone or in combination with at least one of the secondary criteria, 36% (17/47) of the inshore areas met two of the primary criteria (Uniqueness/Aggregation: 2, Aggregation/Fitness Consequences: 15), and 15% (7/47) met only one of the primary criteria (Uniqueness: 2, Aggregation: 5) (Table 4). Sixteen inshore areas (34%) met all five criteria although some of the areas were ranked low for certain criteria.

Inshore areas were identified as proposed EBSAs for various reasons. Approximately 30% of the areas were identified as highly productive, the majority of which were associated with macrophyte beds, primarily eelgrass or kelp. Eleven of the 47 inshore areas were described as having eelgrass beds.

About 47% of the inshore areas were identified as proposed EBSAs, in part, due to the presence of birds (BirdLife International's Important Bird Areas, important wintering/spring areas or colonies of breeding, molting birds). Six inshore areas were identified, in part, because of the presence of endangered birds (Piping Plover, Harlequin Duck or Roseate Tern).

Two other inshore areas were identified, in part, because of the presence of species at risk: the LaHave River and islands area for the endangered Atlantic whitefish, and the Sydney River-Sydney Harbour area for the yellow lamp mussel, a species of special concern.

About 23% of inshore areas were identified in part because of spawning (herring, cod) or for the potential for species (e.g., lobster) to reproduce in the area.

Almost half (47%) of the inshore areas were identified by three primary criteria, compared to 31% for offshore areas (Table 4). Two primary criteria were chosen to describe 36% and 38% of inshore and offshore areas, respectively. Fifteen percent of inshore areas were identified by one primary criterion, compared to 31% for the offshore areas. The secondary criteria of naturalness and resilience were selected more often in the inshore than the offshore.

Discussion

A total of 88 locations of the Scotian Shelf and environs were proposed by scientific experts as being ecologically and biologically significant. Interestingly the offshore locations identified most often as EBSAs (Northeast Channel, the Gully, Haldimand Canyon, Shortland Canyon, and the Stone Fence and Laurentian environs) (Figure 5) are all located at the edge of the Scotian Shelf and have highly dynamic currents, highly variable and complex bathymetry (high benthic rugosity) and include deep water (> 500m depth) features (T. Horsman unpublished data). Many threatened species are known to inhabit some or all of these areas, including the northern bottlenose whale (Hooker et al. 2002), North Atlantic right whale, blue whale (Smedbol et al. 2005), leatherback turtle (James et al. 2005), and many large pelagic species such as tuna and sharks, including shortfin mako and porbeagle sharks (based on commercial catch locations for landings reported to DFO). These are also areas where corals are either known or expected to be present.

The four inshore areas identified as EBSAs by a minimum of five experts (Lobster Bay, Cape Sable Island area, Bird Islands area and St. Paul's Island area) (Figure 7) have an abundance of birds and lobsters. Three are island areas, two of which, the Bird Islands and St. Paul's Island areas, are also known for having concentrations of marine mammals.

Aggregation was the criterion most frequently selected (85% of areas) to describe proposed EBSAs in both the offshore (32 of 42) and inshore (44 of 47). Typically, areas were identified for aggregations of at least two species. In the offshore, only four of the 42 areas were identified due to the aggregation of a single species: two areas on the northern edge of Georges Bank for herring and the tube worm, *F. implexa*, respectively; deep holes north of Banquereau for snow crab; and deep holes of Canso for lobster. In comparison, for the inshore eleven areas of 44 selected for aggregation were identified due to the aggregation of a single species and 33 areas due to aggregations of at least two species. Thus most of the areas identified have aggregations of several species, suggesting that they are highly productive areas and perhaps hotspots for more than once species.

Interestingly, the majority of the proposed inshore EBSAs are close to shore; most of the inshore areas do not extend seaward to the 12 NM limit. The exceptions include two areas off southwestern Nova Scotia (Southwest Nova Scotia Shelf, Nearshore Southwest Nova), three areas off eastern Cape Breton (Western Sydney Bight, Cabot Strait-Asby Bay to St. Paul's Island, St. Paul's Island Area) and one area (deep holes of Canso) along the Atlantic coast.

The lack of proposed inshore EBSAs extending toward the 12 NM limit may be somewhat indicative of the lack of biophysical information available for these areas. There is currently very limited knowledge of the use of the inshore ecosystem by fish, marine mammals, invertebrates, and marine plants (e.g., distribution, spawning areas,

feeding areas, nursery areas). The DFO Research Vessel Trawl Survey has an inshore limit of 50 fathoms or 12 NM. Thus there are no trawl survey data for the inshore area. This is a significant knowledge gap.

The identification of EBSAs closer to shore may also be indicative of the important and unique role of aquatic ecosystems at the land/water interface. The shallow water zones support plant life that do not exist in deeper water, even within the "inshore", and this marine vegetation provides both nutrients and 3-dimensional structure/shelter that support a diversity of organisms and life stages (e.g., larval fish, ducks, shorebirds, etc.) in addition to the species that have evolved as "specialists" in the harsh inter-tidal environments.

Many of the proposed inshore EBSAs may be based on observational data or limited inshore studies. However, much of the information required to identify inshore EBSAs is currently being gathered through a concurrent project which began in 2005, the DFO/Fishermen and Scientists Research Society Project for Inshore Ecosystem Research on the Scotian Shelf in support of an Inshore Ecosystem Overview and Assessment Report and Definition of EBSAs. In particular, directed EBSA research of this project will focus on:

- Fishery independent surveys of areas of interest to ground truth and supplement fishery information
- Fishery independent observation of flora and fauna associations with bottom type using habitat image analysis
- Definition of inshore habitat use by marine mammals, diadromous fish and marine fishes and invertebrates
- Monitoring of environmental and oceanographic data
- Local ecological knowledge survey of commercial fishermen

Although proposed EBSAs in this report are discussed as either inshore or offshore areas, there is a need to address the interactions between these areas (e.g., animals moving between offshore and inshore areas) (Figure 8). In addition, areas not proposed as EBSAs should not be assumed to be unimportant or not ecologically significant. They may be areas for which 1) information exists but the areas are not considered important based on EBSA criteria, 2) information exists but is insufficient to assess the ecological importance of the area, or 3) little to no information exists. It is important to recognize why areas have not been proposed as EBSAs.

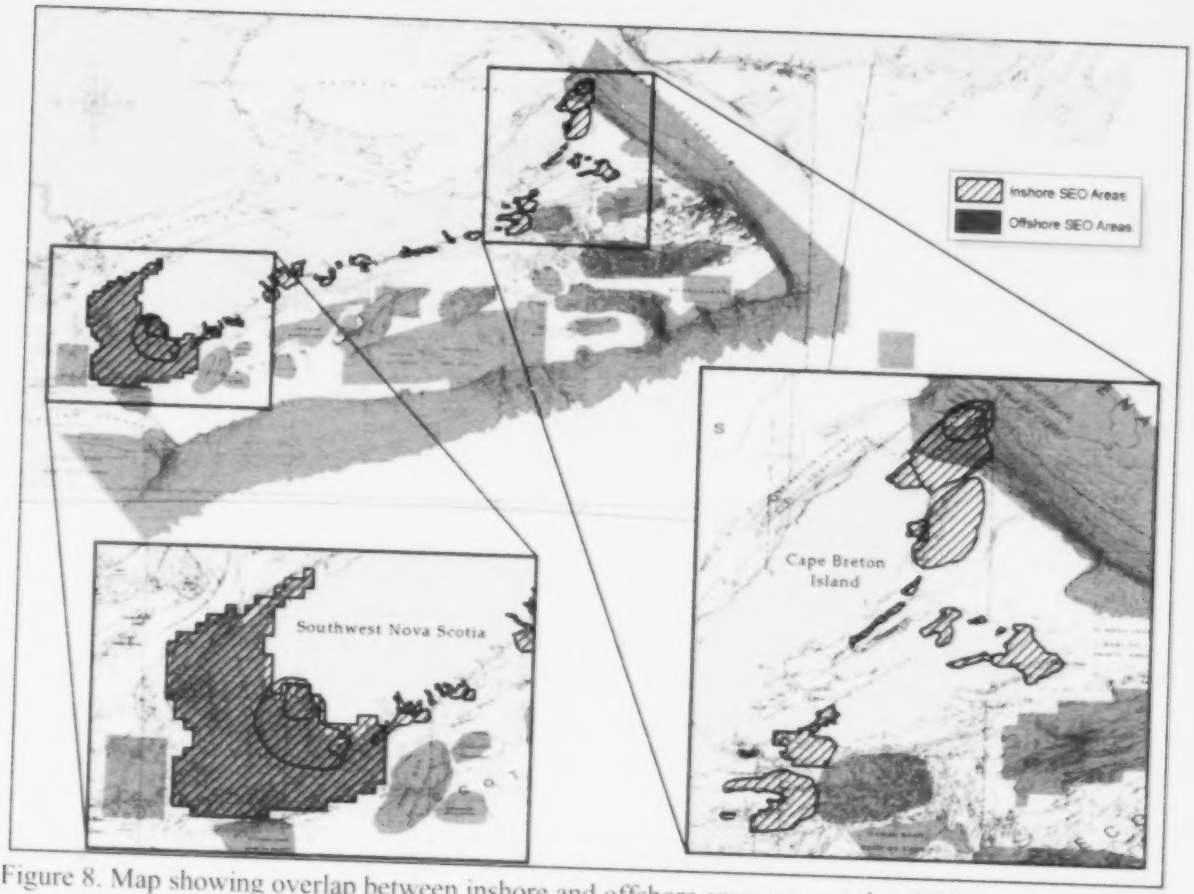

Figure 8. Map showing overlap between inshore and offshore areas proposed as EBSAs

During this study, the issue was raised of whether EBSAs should be identified based on historical and potential future ecological significance. The rationale being that there are habitats that may not currently support species which were once present but which may be significant to population or species recovery. For example, there are many rivers along the Atlantic coast of Nova Scotia that once supported salmon populations. Without considering the historical context and the potential importance of these areas to population or species recovery the ecological and biological significance may not be apparent. Historical ecological and biological significance is an important factor to be considered in the identification of EBSAs.

As with any study, there are caveats to interpreting the results. Although effort was made to include participation of experts from various disciplines to ensure a comprehensive approach to identifying EBSAs, it is possible that another group of scientists might have come up with a different list of proposed EBSAs on the Scotian Shelf. However, this work does not represent the only effort by DFO to synthesize ecologically important areas in the Maritimes Region and specifically the Scotian Shelf and Slope in recent years. The discussion paper by Breeze (2004), *Review of Criteria for Selecting*

Ecologically Significant Areas of the Scotian Shelf: A discussion paper, produced a very similar list of ecologically significant areas for the Scotian Shelf. Twenty-two areas of known or potential ecological significance on the Scotian Shelf and Slope are profiled in the paper. Following is a comparison of the results (Table 6) of the scientific expert opinion EBSA identification exercise (documented here) with the results of Breeze (2004). Note that the study area for the discussion paper does not include Georges Bank, whereas, in this process information was collected and documented for adjacent areas including Georges Bank.

The purpose of the Breeze (2004) discussion paper was to select areas where valued ecological attributes are present to a greater degree than others within the study area based on scientific evidence. Breeze (2004) notes "The profiles do not constitute a comprehensive listing of all ecologically significant areas, but a listing based on the author's analysis using selected indicators for ecological significance." The criteria for determining ecological significance of areas for the discussion paper have similarities to the national guidelines for the identification of EBSAs but are not identical. Primary criteria included: biological productivity; biodiversity; reproductive areas; non-reproductive bottleneck areas; habitat for endangered or threatened species; rare or unique habitats and habitat for rare species; and naturalness. Additional weighting criteria were also applied which included: dependency/survival; fragility/sensitivity; and significance (i.e., local, regional, global). A full description of the methods used to determine these areas can be found in the discussion paper.

Table 6. Comparison of ecologically significant areas identified by Breeze (2004) and those identified in the current scientific expert opinion (SEO) study

Area identified by Breeze (2004)	Criteria from Breeze (2004)	Area identified during SEO workshop & interviews	Criteria used during SEO workshop and interviews
1. Sydney Bight	• Biological productivity • Biodiversity • Reproductive area • Bottleneck area	Inshore # 43 "Western Sydney Bight"	• Uniqueness • Aggregation • Fitness consequences • Resilience • Naturalness
2. Cabot Strait, Laurentian Channel	• Biodiversity • Bottleneck area • Habitat for endangered/threatened species	Offshore # 37 & #38 "Laurentian Channel & Slope" "Laurentian Channel Slope"	• Uniqueness • Aggregation • Fitness consequences • Naturalness
3. Stone Fence	• Biodiversity • Rare/unique habitat/species • Possibly productivity and naturalness	Offshore # 36 "Stone Fence and Laurentian Environs"	• Uniqueness • Aggregation • Resilience • Naturalness
4. Shrimp Holes of the Eastern Scotian Shelf	• Biological productivity • Possibly reproductive area	Offshore # 32 "Deep Holes north of Banquereau"	• Aggregation • Fitness consequences
5. Southwest peak of Banquereau	• Biological productivity • Bottleneck area	Captured in extents for Offshore # 24, "The Gully" and #26 "Shortland Canyon"	• Uniqueness • Aggregation • Fitness consequences • Resilience
6. The Gully	• Biological productivity • Biodiversity • Habitat for endangered/threatened species • Rare/unique habitat/species • Naturalness	Offshore # 24, "The Gully"	• Uniqueness • Aggregation • Fitness consequences • Resilience
7. Shortland and Haldimand Submarine Canyons	• Habitat for endangered/threatened species • Rare/unique habitat/species • Possibly productivity, biodiversity and naturalness	Offshore # 25 "Haldimand Canyon" and #26 "Shortland Canyon"	• Uniqueness • Aggregation • Fitness consequences • Resilience
8. Middle Bank	• Biological productivity • Biodiversity	Offshore # 29 "Middle Bank"	• Fitness consequences

Table 6 *cont'd.* Comparison of ecologically significant areas identified by Breeze (2004) and those identified in the current scientific expert opinion (SEO) study

Area identified by Breeze (2004)	Criteria from Breeze (2004)	Area identified during SEO workshop & interviews	Criteria used during SEO workshop and interviews
9. The Patch and area	• Biodiversity Rare/unique habitat/species	Offshore # 16 "Emerald Basin and The Patch"	• Uniqueness • Aggregation • Resilience Naturalness
10. Sable Island and Shoals	• Reproductive area • Habitat for endangered/threatened species Rare/unique habitat/species	Offshore # 23 "Sable Island Area"	• Uniqueness • Aggregation Fitness consequences
11. Western-Emerald Bank Complex	• Biodiversity • Reproductive area • Habitat for endangered/threatened species	Offshore # 17 through # 21: "Emerald Bank" "Emerald Bank – Hot Box" "Western Bank" "Eastern, Western and Sable Bank"	• Uniqueness • Aggregation • Fitness consequences • Resilience • Naturalness
12. Emerald Basin	• Biological productivity • Reproductive area • Habitat for endangered/threatened species	Offshore # 16 "Emerald Basin and The Patch"	• Uniqueness • Aggregation • Resilience • Naturalness
13. Browns Bank	• Biological productivity Reproductive area	Partially represented in Offshore # 6 "Browns Bank and edge slope" and # 7 "Fundian Moraine"	• Uniqueness • Aggregation Fitness consequences
14. Northeast Channel	• Rare/unique habitat/species	Offshore # 5 "Northeast Channel"	• Uniqueness • Aggregation
15. Roseway Basin	• Biological productivity • Reproductive area • Habitat for endangered/threatened species	Offshore # 9 "Roseway Basin"	• Uniqueness • Aggregation • Fitness consequences • Resilience • Naturalness
16. Scallop Fishing Area 29 – west Baccaro	• Reproductive area	Offshore # 8 "Southwest Nova and frontal area from Browns Bank" and Inshore # 1- 4: "Southwest Nova Scotia", Nearshore Southwest Nova", "Lobster Bay", "Cape Sable Island area"	• Uniqueness • Aggregation • Fitness consequences • Resilience • Naturalness

Table 6 *cont'd*. Comparison of ecologically significant areas identified by Breeze (2004) and those identified in the current scientific expert opinion (SEO) study

Area identified by Breeze (2004)	Criteria from Breeze (2004)	Area identified during SEO workshop & interviews	Criteria used during SEO workshop and interviews
17. Cold Seep Communities, Eastern Valley, Laurentian Fan	• Biodiversity • Rare/unique habitat/species • Possibly naturalness	Offshore # 41 "Laurentian Channel Cold Seep"	• Uniqueness • Naturalness
18. LaHave Bank	• Naturalness	Offshore # 12 "LaHave Bank"	• Uniqueness • Aggregation • Fitness consequences
19. Areas with very little bottom fishing activity: i. Canso Bank ii. Western Gully iii. Areas of Misaine Bank	• Naturalness • Possibly biodiversity on Canso Bank)	i. Offshore # 30 "Canso Bank" ii. Captured in Offshore # 20 "Western Bank" iii. Not represented	<u>Canso Bank</u> • Fitness consequences <u>Western Bank</u> • Uniqueness • Aggregation

Of the 22 ecologically significant areas identified by Breeze (2004), all but one (areas of Misaine Bank) were also identified by scientific expert opinion in the current study. However, the complex benthic area north of Banquereau was identified in the current study as an area requiring further research and likely corresponds to Breeze's areas of Misaine Bank. This comparison illustrates that while the areas identified as ecologically or biologically significant are frequently similar, the rationale for selecting these areas are not always the same.

Criteria chosen to describe a proposed EBSA in the current study may not adequately reflect the actual criteria or characteristics for that area. While interpreting information on the site selection forms provided by study participants, it was noted that areas identified as meeting certain criteria were described on the same form with potentially contradictory information. This was also true of the boundaries drawn on the maps which were sometimes depicted differently in the supporting text provided. It is likely that the perception of how an area meets the EBSA criteria or how the boundaries for the area should be defined could change following the incorporation of biophysical data analyses, traditional ecological knowledge (TEK) or with new information. Thus it is important that ranking of the proposed EBSAs occurs only after all available information has been analyzed. Therefore this study does not include a ranked list of proposed EBSAs. The authors strongly recommend that the criteria chosen for each proposed EBSA be revisited following such analyses.

The information gathered during the workshop and subsequent interviews with key scientific experts represents one of several components in the process to identify EBSAs on the Scotian Shelf. The scientific expert opinion component of the process to identify EBSAs is described in detail in this report.[3] It should also be noted that the boundaries of these proposed EBSAs

[3] Areas listed in Tables 1 and 5 do not represent the final list of EBSAs.

may require, or benefit from, revision based upon supporting spatially referenced data, including data that were identified by the scientists during this study.

Conclusion

Next Steps in the Identification Phase

The information presented here, together with other sources of information, including biological and physical data and fishermen's knowledge, will be used to identify, refine and finalize the boundaries of EBSAs on the Scotian Shelf.

Available biological and physical data for each of the proposed EBSAs based on scientific expert opinion are being compiled and analyzed by DFO Science to provide both qualitative and quantitative information about the ecological and biological properties for each of the EBSAs. This information will provide insight into the rationale for choosing these areas and our knowledge and data gaps. In addition, conservation objectives for each EBSA are being developed based on DFO's guidance document (DFO 2007).

Management Implications

Concluding that an area is ecologically or biologically significant does not give it any legal status. However, such a conclusion provides guidance on the appropriate attention to management that is expected in these areas. The overall purpose for identifying EBSAs is to "facilitate a greater-than-usual degree of risk aversion in management of activities in such areas" (DFO 2004). Given that EBSAs have no legal status, more discussion on their use in ocean planning and management is required.

For EBSAs on the Scotian Shelf, the Oceans and Coastal Management Division will lead and prepare a use and risk analysis, vulnerability/sensitivity assessment, and develop management recommendations and appropriate monitoring options. This process is comprised of the following:

Vulnerability/Sensitivity Assessment: Working with Science Branch, identify and analyse the properties that make the area ecologically significant and subsequently require safeguarding. For example, if the area has been proposed as an EBSA because it is important for juvenile fish, a determination of the properties of that area that are important for juvenile fish is necessary (e.g., do fish use the area at any particular time of year, do they require a specific habitat type such as intact gravel beds).

Use & Risk Analysis: Assess current human activities/usage in each EBSA and whether these activities have potential to interact and impact on the properties/species/habitats that give ecological significance to the area.

Economic Valuation: Assess economic valuation of current and historic fishing activity in each EBSA.

Management Recommendations and Advice: Make recommendations on management options and strategies for safeguarding each EBSA (e.g., limit activities that impact benthic habitat). This can include identifying specific management measures that could be taken (e.g., legislation, authority, non-regulatory tool, policy, code of conduct, etc.). Recommendations should be linked, but not limited to, the conservation objectives identified for each EBSA, and to the properties/species/habitat that make the area ecologically significant and require safeguarding.

Implementation and Monitoring: Determine and implement appropriate monitoring programs for the properties/species/habitat that make the area significant. This will ensure that the analysis conducted for the area is continually reviewed and that any management measures put in place are actually providing the desired protection. Monitoring should be based on the conservation objectives set for the area.

The process of determining the management regime for EBSAs should be incorporated into the integrated management process. For example, this effort will be essential to achieving many key ecosystem objectives for the Eastern Scotian Shelf Integrated Management area (ESSIM), particularly those related to the conservation of habitat integrity and biodiversity. Additionally, EBSA analysis and management should be incorporated into the processes of federal and provincial regulators with authority in the EBSA (e.g. fisheries management plans, planning for aquaculture site selection and natural resource exploitation, etc.) and taken into consideration when applying the habitat protection provisions of the *Fisheries Act* and in environmental assessment processes.

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Appendix 1. Methodologies for Identifying and Mapping Ecologically and Biologically Significant Areas on the Scotian Shelf

Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf

Gathering Scientific Expert Opinion for Identification of Ecologically and Biologically Significant Areas on the Scotian Shelf

January 18 and 19, 2006

Participants' Workbook

Gathering Scientific Expert Opinion for Identification of Ecologically and Biologically Significant Areas on the Scotian Shelf

January 18 and 19, 2006

Background Information

In order to support the integrated, ecosystem-based management of Canada's oceans, Fisheries and Oceans Canada is undertaking programs to identify ecologically and biologically significant areas (EBSAs) in a number of regions, including the Scotian Shelf. Identifying EBSAs is not a general strategy for protecting all habitats and marine communities that have some ecological significance. Rather it is a tool for drawing attention to an area that has **particularly high ecological or biological significance**, to facilitate provision of a greater-than-usual degree of risk aversion in management of activities in the area.

To identify an area as "significant" is to conclude that if the area or species were disturbed severely, the ecological consequences (in space, time, or outward in the community) would be greater than an equal perturbation of most other areas or species. Although societal values and potential threats play a role in determining the management measures that may be applied to EBSAs, **threats and values ARE NOT considerations** in the identification of EBSAs.

As outlined in the Ecosystem Status Report 2004/006 (Identification of EBSAs), experiential knowledge must be included in the process of identifying EBSAs. This session of the workshop is designed to gather scientific expert opinion which is based on a life's work rather than any particular project or set of data, thus is not readily accessible from the literature. The information gathered in this session will be combined with other sources of information, including scientific data and local ecological knowledge, to identify EBSAs on the Scotian Shelf.

Mapping Exercise 1: Identify EBSAs
January 18, 2006
1:00 – 4:30pm

Purpose

The purpose of Exercise 1 is to **identify areas of particularly high ecological and biological significance** on the Scotian Shelf. For this exercise, participants will be divided into working groups of mixed expertise, which will focus on either nearshore or offshore regions. The goals for each group are:

1) to identify areas that meet each of the EBSA criteria independently,
2) to draw approximate boundaries of these areas on a chart, and
3) to record rationales for choosing each area.

Methods

1) As a group, identify areas that meet at least one of the primary EBSA criteria (uniqueness, aggregation, fitness consequences) **to a higher degree** than other similar areas (or areas with similar characteristics). Fill in the EBSA Criteria Matrix, indicating the areas that also meet either of the secondary criteria (resilience, naturalness). General comments are sufficient for filling in the Matrix (e.g., unique cod spawning area).

2) Locate and draw boundaries of each area identified in the Matrix on the chart.
   a. First, draw outlines around the cells on the acetate sheet that encompass the entire boundary of the area of ecological and/or biological significance. Identify each area with a number.

   b. Draw approximate boundaries of each area directly on the chart, if possible. Identify each area with a number. Ensure that the number of each area is the same as the number of the corresponding area in a).

Note: To ensure that the group considers areas of particularly high ecological and biological significance and to prevent the group from selecting the entire Scotian Shelf, **no more than 40% of the nearshore or offshore region can be identified as areas of ecological and/or biological significance.**

3) For each area identified on the chart, complete a Site Selection Form with as much detail as possible, providing the rationale for selecting the areas as an area of particularly high ecological and biological significance. Ensure that the number of the site is written at the top of the form and that it corresponds to the site identified on the chart, and that the cell numbers that encompass the area on the chart are written on the top of the form.

Note: Following Exercise 1, all the working groups' selections will be superimposed into one map with areas shaded in accordance with the degree of overlap. Exercise 2 (January 19, 2006) will focus on refining the boundaries of the identified areas to a finer scale.

Questions for Consideration

1) Are there areas you consider to be of particularly high ecological and biological significance that were not identified in this exercise because they did not meet the EBSA criteria? If yes, which areas and why do you consider them to be ecologically and biologically significant?

2) Would you recommend any additions/modifications to the EBSA criteria? If yes, please explain.

3) For general areas where you have not identified areas of particularly high ecological and biological significance, please record your rationale (e.g., lack of data in that area or the area is not considered of high significance according to criteria). If lack of data, what information is needed? Should data-poor areas be considered EBSAs on a precautionary basis?

4) If areas were selected that together comprised more than 40% of the offshore or nearshore area, how did you decide which areas would be included and which would be left out? Do you think that the areas you excluded because of the 40% cut off should actually have been included as EBSAs?

Mapping Exercise 2: Review and Refine EBSAs
January 19, 2006
1:00 – 4:00pm

Purpose

The purpose of Exercise 2 is to review and refine the boundaries of the areas of high ecological and biological significance identified in Exercise 1. For this exercise, participants will be divided into working groups by geographic region on the Scotian Shelf, with members having differing expertise. The goals for each group are:

1) to review the results of Exercise 1,
2) to refine the boundaries of areas identified in Exercise 1,
3) to produce a new chart with finer scale boundaries of significant areas,
4) to provide additional information on the Site Selection Form, and
5) to identify areas of particularly high ecological and biological significance not selected in Exercise 1.

Methods

1) Review and discuss the areas identified in your geographic region, noting the degree of overlap.

2) Review the Site Selection Forms for each area and discuss the rationale used for identifying the area as ecologically and/or biologically significant. Comment on any information that you feel is incorrect or lacking, noting any additional information that should be included (e.g., additional reasons why the area should be considered ecologically and biologically significant) or reasons why the area should not be considered ecologically and/or biologically significant.

3) If possible, draw an approximate boundary of each area on the Loran chart.
    a. Elaborate on any comments/rationale regarding the positioning of the boundary for each area.
    b. If you are not comfortable drawing approximate boundaries of an area, discuss the reasons why (e.g., the group doesn't feel it has enough expertise to define the boundaries of the area, there is not enough data available to help define the boundary, etc.). If the reason includes a lack of data, provide details as to which data are required.

4) Discuss any additional areas of particularly high ecological and biological significance within your geographic region that are not identified on the chart.

5) For each newly identified area,
    a. draw its approximate boundaries on the Loran chart, and
    b. complete a new Site Selection Form with as much detail as possible, providing the rationale for selecting the area as an area of high ecological and biological significance.

    Ensure that the number of the site is written at the top of the form and that it corresponds to the site identified on the chart.

Note: After the workshop, the boundaries of areas of particularly high ecological or biological significance identified by experts will be digitized, and all comments and records relevant to each identified EBSA will be stored in a GIS. In addition to assisting in identifying EBSAs, the information collected at the workshop may also be used for other planning and decision-making processes for oceans management.

Questions for Consideration

1) If EBSAs in your geographic region together comprise more than 40% of the offshore or nearshore area, which EBSAs will you include and which will you leave out? On what do you base your decision? Are there arguments for including more than 40% of the area?

2) Given the EBSAs identified in your geographic region on the Scotian Shelf, can you choose the 3 areas that are the most significant according to EBSA criteria? If yes, which areas and why? If not, why not? On what do you base your decision?

3) In general, when comparing EBSAs are there particular criteria (e.g., uniqueness, aggregation, fitness consequences, resilience, naturalness) that you think are more important and should be ranked higher in every case? If yes, which criteria and can you think of any instances when this should not be the case?

4) Now that you have gone through the process of considering and identifying areas that meet the EBSA criteria, are you confident that these criteria will capture all areas of high ecological and biological significance on the Scotian Shelf? Are there ecologically and biologically significant areas that you anticipate will not be captured under the current EBSA criteria?

5) Do you think that the exercises conducted at this workshop were sufficiently rigorous that the outcomes can be used to identify EBSAs based on scientific expert opinion? What else needs to be done to identify EBSAs with reasonable confidence? Should the outcomes of these exercises be used at all?

6) Do you think that significantly different outcomes would have been achieved if each individual had drawn their own map rather than working together as a group? If so, do you think that EBSAs may have been left out because of the group process?

Appendix 2. Site Selection Form

Working group code _____ **Site number** _____

Cell numbers that encompass the area on the chart _____

Site name (commonly used name or location, if possible) _____

Description of location of EBSA (include any of the following: GIS reference such as a single coordinate or table of points; any landmarks, topography or physical features; distance from shore, island, town, fishing ground, approximate depth and area, etc.).

_____

_____

_____

_____

_____

_____

_____

_____

_____

Check off the criterion(a) that the area meets

__Uniqueness
__Aggregation
__Fitness Consequences
__Resilience
__Naturalness

General description of ecological and/or biological significance (e.g., is this an area with highly productive or diverse communities; a spawning, breeding or feeding area; a migration route, an area with macrophyte beds, etc.?).

_____

_____

_____

_____

_____

_____

_____

_____

_____

Is this area linked to a particular fish/invertebrate species, marine mammal or seabird? Does it concern a geographically rare, threatened or endangered species (as identified under the *Species at Risk Act* or as assessed by COSEWIC) or a commercial species? If so, please identify and comment.

Is the reason you consider the area to be ecologically and biologically significant (e.g., spawning area, feeding grounds, etc.) a seasonal or year-round occurrence? If a seasonal occurrence, please identify the season(s)/month(s) as well as the reason (e.g., migration route for blue whale from June to October).

Are the boundaries of the area variable in time (e.g., do the boundaries for spawning or feeding areas fluctuate from season to season, year to year)? If yes, please explain.

What is the level of information available for this area? _____

What information is needed to better define the ecological and biological characteristics in this area?

Is the boundary you've drawn on the map a rough estimate or a good approximation (i.e., how confident are you of the boundary you have drawn)?

Please identify any information/data sources used in the identification of the EBSA (e.g., published/unpublished papers, datasets, etc.)

Contact(s) (name/address/telephone/email)

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